

June 9, 2015

To: U.S. Global Change Research Program

From: American Society of Civil Engineers

Subject: ASCE Input to the Sustained National Climate Assessment

The American Society of Civil Engineers (ASCE) recently issued the report *Adapting Infrastructure and Civil Engineering Practice to a Changing Climate*. It is freely available to the public at <<http://dx.doi.org/10.1061/9780784479193>>. Note that infrastructure includes: buildings of all types and facilities for communications, energy generation and distribution, industry, transportation of all modes, waste management, water resources, and urban potable, storm and waste water.

The thoroughly documented recommendations of the report are:

1. Engineers should engage in cooperative research involving scientists from across many disciplines to gain an adequate, probabilistic understanding of the magnitudes of future extremes and their consequences. Doing so will improve the relevance of modeling and observations for use in the planning, design, operation, maintenance and renewal of the built and natural environment. It is only when engineers work closely with scientists that the needs of the engineering community become fully understood, the limitations of the scientific knowledge become more transparent to engineers, and the uncertainties of the projections of future climate effects become fully recognized for engineering design purposes.
2. Practicing engineers, project stakeholders, policy makers and decision makers should be informed about the uncertainty in projecting future climate and the reasons for the uncertainty, as elucidated by the climate science community. Because the uncertainty associated with future climate is not completely quantifiable, if projections of future climate are to be used in engineering practice it will require considerable engineering

judgment to balance the costs of mitigating risk through adaptation against the potential consequences of failure.

3. Engineers should develop a new paradigm for engineering practice in a world in which climate is changing, but cannot be projected with a high degree of certainty. When it is not possible to fully define and estimate the risks and potential costs of a project and reduce the uncertainty in the timeframe in which action should be taken, engineers should use low-regret, adaptive strategies such as the observational method to make a project more resilient to future climate and weather extremes. Engineers should seek alternatives that do well across a range of possible future conditions.
4. Critical infrastructure that is most threatened by changing climate in a given region should be identified, and decision makers and the public should be made aware of this assessment. An engineering-economic evaluation of the costs and benefits of strategies for resilience of critical infrastructure at national, state and local levels should be undertaken.

Official ASCE Policy Statements support governmental actions to mitigate and adapt to a changing climate:

- Policy Statement 360 *Impact of Climate Change* <http://www.asce.org/issues-and-advocacy/public-policy/policy-statement-360---impact-of-climate-change/>
- Policy Statement 488 *Greenhouse Gases* <http://www.asce.org/issues-and-advocacy/public-policy/policy-statement-488---greenhouse-gases/>

The following activities in the USGCRP Sustained Assessment are needed to implement the recommendations of the ASCE report and are organized according to the questions given by USGCRP for public input.

1. What scientific information on climate change, impacts, and responses would be most valuable for future assessment activities?
  - a. The functionality, durability and safety of infrastructure are placed at risk by extremes of climate and weather. Research, including modeling and observations, by climate and weather scientists in collaboration with engineers, other built environment professionals and environmental and social scientists is needed to gain an adequate, probabilistic understanding of the magnitudes of future extremes, their effects on infrastructure systems and their economic, environmental and social consequences.
  - b. The implementation of low-regret adaptive strategies such as the observational method for the design and operation of infrastructure

systems must comply with regulations of cognizant federal, state and local regulatory authorities. Such regulations commonly refer to national consensus standards produced by organizations such as ASCE. Research is needed to address the public policy, financial and legal issues, as well as the scientific and technical issues, involved in incorporating low-regret adaptive strategies and the observational method in regulations and in the standards upon which the regulations are based.

- c. Infrastructure systems, through their whole life cycles of design, construction, operation, maintenance and renovation or removal, are major contributors to the greenhouse gas emissions which influence climate and weather. Research is needed to inform the development and operation of infrastructure systems that will produce needed services with substantially reduced greenhouse gas emissions.

2. How to more effectively communicate assessment findings?

ASCE and other professional and trade associations of the professions and industries serving the built environment have effective communication mechanisms for informing their members, peer organizations and policy makers. These mechanisms will serve well in disseminating and implementing knowledge gained from the research described above. In addition, USGCRP and the Sustained Assessment, in cooperation with the member organizations of the National Climate Assessment Network, can inform the general public on issues and knowledge important for the mitigation of and adaptation to a changing climate.

3. How the National Climate Assessment can better connect with other assessment efforts, such as those at the regional, state, tribal, and local levels?

Sustainability and resilience rating systems for the built environment, including the Envision™ system of the Institute for Sustainable Infrastructure (ISI), the LEED family of rating systems of the U.S. Green Building Council (USGBC) and the Green Globes rating system for buildings of the Green Building Initiative (GBI), provide effective mechanisms for inspiring and recognizing accomplishments in mitigating and adapting to a changing climate. The Sustained Assessment can support research and development needed for improved consideration of mitigation of and adaptation to a changing climate in such rating systems and encourage participation of such organizations in the National Climate Assessment Network (USGBC already participates as does ASCE - a partner in ISI).